

REMARKS

Claims 1 and 3-37 are pending in the application. Claim 1 has been amended and claim 37 added herein. Favorable reconsideration of the application is respectfully requested in view of the following clarifying comments.

Support for the claim amendments may be found, for example, at page 9, lines 7-18; and the paragraph bridging pages 12-13 in the Substitute Specification.

I. REJECTION OF CLAIMS 1 AND 3-36 UNDER 35 USC §103(a)

Claims 1 and 3-36 remain rejected under 35 USC §103(a) based on *Tanaka-SID* in view of *Tanaka et al. '688*, alone or in combination with one or more tertiary references. Applicant respectfully requests withdrawal of each of the rejections for at least the following reasons.

Applicants previously argued the detrimental effects of the combination of *Tanaka-SID* in view of *Tanaka et al. '688* in the sense that the high frequency source of *Tanaka-SID* coupled to the capacitance of the pixel sensors presents significant problems such as with parasitic capacitance. The Examiner indicates in the Advisory Action that the increased pixel count and parasitic effects from an increase in the frequency of the signal would be issues that *Tanaka-SID* would have to deal with.

In order to further emphasize the distinctions between the present invention and any proposed combination of *Tanaka-SID* and *Tanaka et al. '688*, applicant has amended claim 1. Specifically, applicant has amended claim 1 to express how the sensor signals are “generated from charge transfers produced by capacitance changes within the optically variable region of the display picture elements”. As described below, such difference in how the signals are generated compared to the high-frequency approach of *Tanaka-SID* and *Tanaka et al. '688* are significant.

In general, capacitance measuring techniques can be broken into 2 categories (see Figure 1 below): high frequency and quasi-static.

High frequency methods such as in *Tanaka-SID* employ an alternating waveform which is applied across the two terminals of the capacitor. The resulting current is measured and the capacitance calculated from the simple relationship

Low frequency methods on the other hand, otherwise known as quasi-static methods, employ a step change in voltage which is applied to a first terminal of the capacitor whilst a second terminal remains at a constant level. The charge movement at the first terminal due to this step change is measured to give the capacitance from the simple relationship $Q=CV$. Alternatively, a fixed quantity of charge may be added or removed from the capacitance and the change in voltage measured.

The "Versatile Type" method proposed by *Tanaka-SID* to measure the capacitance of a liquid crystal pixel is based on the high frequency method. The method described in our application, and as recited in amended claim 1, is based on the quasi-static method.

It further is noted that there exist several key features of an active matrix LCD, not found in a passive matrix LCD, that make the application of high frequency capacitance measuring methods ineffective.

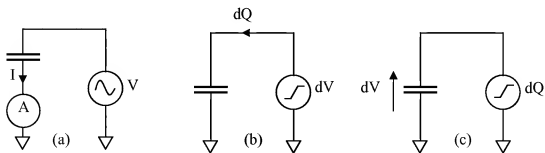


Figure 1: Capacitance measuring methods (a) High Frequency; and (b), (c) Quasi-Static

In order to measure the pixel capacitance according to the method described in *Tanaka-SID*, a high frequency alternating signal must be applied to a first capacitor terminal and measured on the second capacitor terminal. In practice, for even a modest size of display, it is extremely difficult (if not impossible) for the capacitance sensor to function as intended due to parasitic effects. Specifically, a low pass-filter is formed in the signal path from counter plate to column output that acts to block the high frequency alternating signal used to measure the pixel capacitance. Parasitic components that contribute to this low-pass filter are:

- the parasitic resistance and capacitance of the counter plate
- the parasitic resistance and capacitance of the column addressing line
- the parasitic resistance of the pixel TFT switch and parasitic capacitance of the pixel storage capacitor

In accordance with the presently claimed invention, capacitance measurement is performed by means of a static, or quasi-static, operation. As described above, such quasi-static method means that a measurement of charge must be made as opposed to current. For example, as in the operation of the charge-transfer amplifier described in the present application (and recited in new claim 37), a change in voltage may be recorded after an injection of charge. In such a measurement, the low-pass filter formed by the parasitic components has little effect.

Claim 1 has been amended to emphasize the static, or quasi-static output arrangement. Specifically, the sensor signals are generated from charge transfer produced by capacitance changes. This is contrasted with measurement of the high-frequency impedance of the pixel capacitance based on current measurement as in the proposed combination of *Tanaka-SID* and *Tanaka et al.* '688.

The present invention is advantageous, in that it is substantially immune to counter plate noise since any charge injected across the pixel capacitance due to small

variations in the counter plate voltage is negligible compared to charge transferred during the sensing phase of the charge transfer amplifier.

Tanaka et al. '688 discloses that the resistance of the photoconductive layer decreases when light is projected on the photo-detecting section. (Col. 5, Ins. 40-41). Thus, *Tanaka et al.* also fails to teach that charge transfers produced by capacitance changes are used to generate sensor signals.

Accordingly, neither *Tanaka-SID* nor *Tanaka et al. '688* teach or suggest a combination in which sensor signals are generated from charge transfers produced by capacitance changes within an optically variable region of the display picture elements as recited in amended claim 1.

Furthermore, neither *Tanaka-SID* nor *Tanaka et al. '688* teach or suggest specific use of charge transfer amplifiers connected to the column data lines for sensing the charge transfer as recited in new claim 37.

For at least the above reasons, applicant respectfully submits that *Tanaka-SID* and *Tanaka et al. '688* taken alone or in combination do not teach or suggest each and every feature of the claimed invention. Nor do *Tanaka-SID* and *Tanaka et al. '688* teach or suggest the above-described advantages associated with the claimed combination. Moreover, the tertiary references fail to make up for such deficiencies. Withdrawal of the rejection is respectfully requested.

II. CONCLUSION

Accordingly, all claims 1 and 3-37 are believed to be allowable and the application is believed to be in condition for allowance. A prompt action to such end is earnestly solicited.

Should the Examiner feel that a telephone interview would be helpful to facilitate favorable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Should a petition for an extension of time be necessary for the timely reply to the outstanding Office Action (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988.

Respectfully submitted,

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